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Title : CURRENT POPULATION GROWTH RATE AND TWENTIETH CENTURY POPULATION DYNAMICS OF WESTERN GRAY WHALES

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Abstract : Two geographically and genetically distinct populations of gray whales (Eschrichtius robustus) occur in the North Pacific, referred to as the eastern and western populations. After substantial harvests by modern commercial whalers during portions of the 19th and 20th centuries, the western population was erroneously proposed to be extinct during the early 1970's. This population presently numbers approximately 100 individuals and is regarded as one of the world's most endangered large whale populations. Current mark-recapture survival estimates and other life history parameters were utilized in conjunction with the Lotka equation to calculate the 1997-2002 population growth rate of western gray whales. A Monte Carlo simulation method was employed (n=10,000 trials) to account for uncertainty in the life history parameters. A range of possible fecundity values was examined to estimate a conservative, intermediate, and liberal rate of population growth. These growth rates were estimated as 0.026 (SD=0.0190, 5th-95th Percentiles=-0.008-0.054), 0.031 (SD=0.0194, 5th-95th Percentiles=-0.003-0.061), and 0.036 (SD=0.0198, 5th-95th Percentiles=0.001-0.066), respectively. Each calculated growth rate and historical catch data were fitted to the generalized logistic equation in a 20th century back calculation of the western gray whale population. A Bayesian statistical method and the Sample-Importance-Resample algorithm (n_1=2,000,000 initial samples; n_2=5,000 resamples) were used to estimate model parameters and indices of population status. Back calculation results suggest that the western gray whale population should currently be growing at its maximum net recruitment rate given its small population size, the carrying capacity of the population is undefined, the population is currently at most between 8-9% of its original size, and the population has been highly depleted for more than half of the 20th century. Current anthropogenic threats and low-density population effects could delay the recovery of western gray whales, emphasizing the necessity of concerted international protection and conservation planning for this critically endangered population.